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TRANSITIONING TO ELECTRIC VEHICLES - AN EMPIRICAL STUDY

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ABSTRACT

A conceptual framework is developed to measure innovativeness in adopting electric vehicles, considering technology ownership and various psychological and social factors. As fossil fuels deplete and prices rise, the automobile industry in India is turning to electric vehicles as a solution for both industry and the environment. For a sustainable environment, a shift from petrol and diesel vehicles to fully electric vehicles with zero emission through the tailpipe is immensely intrinsic.Electric vehicles possess a wide spectrum of investment opportunities and as a promising mode of mobility companies enhanced their research and development prominently to drive out petroleum as anenergy source (Wilberforce et al., 2017). To attain sustainable development government globally decided to focus on research for developing hybrid electric vehicles that can compete with fossil fuel-dependent (conventional) vehicles.Despite government policies promoting electric vehicles, their market penetration remains low. Transitioning to electric vehicles is essential to reduce greenhouse gas emissions gradually. This study aims to explore and analyze consumer perceptions towards electric vehicles. The study focuses on the components and sources of information about electric vehicles that influence consumer buying decisions and explores the reasons for transitioning to electric vehicles.

KEYWORDS: Electronic Vehicle, Source of Information, Mode Shift

INTRODUCTION

One of the necessities of life is transportation. In the modern world, the conventional combustion engine is swiftly becoming outmoded. Instead of fossil fuels the usage of renewable energy sources helps to reduce the running cost of electric vehicles (EVs) and make it more environment-friendly. The yearly maintenance cost of electric vehicles is considerably cheap as compared to internal combustion vehicles.Zero tailpipe emissions reduce carbon footprint, multiple financial incentives and tax benefits offered by the government on purchasing EVs, suitability of charging at home,and silent functional competence reduce noise pollution are competent traits of Electric Vehicles.

Currently, the issue of air pollution has become a significant problem in India. Recent global reports indicate that many cities in India are among the most polluted in the world. The primary contributors to air pollution are the industrial and transportation sectors, with 51% of pollution coming from industry and 27% from transportation. Air pollution is responsible for causing the premature deaths of 2 million Indians annually. To combat this issue, Electric Vehicles (EVs) can play a crucial role in reducing greenhouse gas emissions. EVs offer various benefits, including lowering pollution levels and reducing oil import costs. India emits approximately 3 Giga tonnes of carbon monoxide, and other greenhouse gases each year, with 25% of these emissions coming from various road transport vehicles. Consequently, many vehicle manufacturers are currently producing different types of EVs. Many people appreciate that EVs are considered Green Vehicles (GVs) and are more environmentally friendly than conventional Internal Combustion Engine Vehicles (ICVs). As the exploitation and pollution of natural resources have increased, there is a growing need for renewable and eco-friendly products. EVs serve as a replacement for petroleum-based vehicles and are considered an emerging technology that is both environmentally friendly and feasible. Replacing internal combustion engines with electric engines will significantly reduce pollution and benefit consumers financially. Numerous countries worldwide have adopted this technology to contribute to environmental improvement. This article will explore the factors influencing consumer purchasing decisions regarding electric vehicles and delve into the reasons for transitioning to EVs in India. Financial stimulants offered by the government to promote EVs are directdiscountssuch as purchase incentives, interest rate discounts for an electric vehicle loan, waived off-road tax at the time of purchase, exemption on one-time registration fees, and other tax and scrapping incentives.

National incentives offered to Electric Vehicle

Total Approximate Incentives	Approximate size of battery
Two-wheelers: Rs 15000/- per kWh up to 40% of the cost of the vehicles	Two Wheelers: 2 kWh
Three-wheelers: Rs 10000/- per kWh	Three Wheelers: 5 kWh
Four wheelers: Rs 10000/- per kWh	Four Wheelers: 15 kWh
E-Buses: Rs 20000/- per kWh	E-Buses: 250 kWh

Source: https://e-amrit.niti.gov.in/electric-vehicle-incentives

LITERATURE REVIEW

Numerous hindrances related to EVs hampered the suitability of long-distance driving which encompass factors like slow battery charging, lack of charging infrastructure and high price. Studies (Egbue and Long, 2012) demonstrated that EVs were consequential enough to subside environmental problems by analyzing the consequences of EVs on air quality. The repercussions of electric vehicles on air quality highlight that EVs reduce nitrogen oxides, carbon monoxide, particulate matter (PM10), and greenhouse gases in the atmosphere. Switching over to Electronic vehicles engendered the feel of conserving the environment among the users and instigated many as it put forward safety and convenience (Skippon and Garwood, 2011). Furthermore (Soltani et al., 2019) the mode shift, to Electronic vehicles from conventional vehicles eventuates due to safety measures and socio-economic components of EVs. The driving range and price wrap up the user preference to espouse EV (Hardman et al., 2018) and apart from this, the study concluded that the most prominent hindrance that restraints the acquisition was its price. Whereas (Caperello and Kurani, 2012) lower running costs roused interest in users to procure EVs. Delusions concerning the long-term benefits of EVs money value also exist as part of unawareness. Recharging electric vehicles consumes much time and demands only a short range which makes it inconvenient for middle-class families whereas makes it suitable for upper-classones who afford EVs as a status symbol rather than a mode of transport (Fridstrom and Ostli, 2021).

Major studies in India (Retna Kumar and Shrimali, 2020 and Varma and Sushil, 2019) knuckle down the hurdles like lack of charging stations, electricity supply for charging EVs, safety perspective, environmentalconcerns and so on for EV purchase. Even though high initial purchase cost was listed as a major barrier it might be neutralised with the low operating cost of electric vehicles tied in with financial government incentives (Letmathe and Suares, 2017). Studies (Breetz and Salon, 2018), (Letmathe and Suares, 2017) concluded that the major challenge faced by EVs is to change the mindset of common people that initial investment in EVs is economically unfeasible. Studies (Sierzchula et al., 2014) put forth the fact that initial investment, running cost, range, charging infrastructure, and government policies influenceconsumers' mode shift behaviour(Bhattacharyya and Thakre, 2020). A rigorous literature review reveals an insight that the initial price of EV varies according to the variation in subsidies, taxation policies, rules and regulations prevailing in countries and states various rules and inducement schemes brought in by various countries. Incentives and inducements given by 20 nations were analyzed and found that the monetary gain and grant was the most preferred incentive for an electric vehicle (Lieven et al.,2011).A significant hindrance to the growth of the Indian electronic vehicle market was consummate as the overall cost of ownership which is the financial and economic constraints (Digalwar and Giridhar, 2015).

OBJECTIVES OF THE STUDY

This study aims to analyse the components and sources of information about electric vehicles that influence consumer buying decisions and explore the reasons for transitioning to electric vehicles.

RESEARCH METHODOLOGY

The research methodology employed is descriptive, with primary data collected from a sample of 148 respondents through an online questionnaire from the Kollam district in Kerala. Hypotheses are tested using the Chi-square test and Multiple Discriminant Analysis.

ANALYSIS AND DISCUSSIONS

Demographic profile of respondents

Demographic Factors	No. of respondents	Percentage
Gender		
Male	94	63.52
Female	54	36.48
Age		
Under 25	11	7.43
25 – 35	71	47.98
35 – 45	57	38.51
Above 45	9	6.08
Marital Status		
Married	68	45.95
Unmarried	80	54.05
Educational Qualification		
HSC	53	35.81
Graduate	69	46.63
Postgraduate	26	17.56

(Source: Primary Data)

Table: 1 Analysis of the Demographic profile of respondents

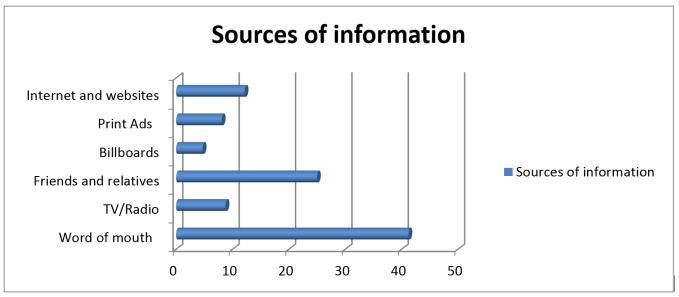
Table 1 presents the demographic characteristics of the 148 respondents included in the study. Among the sample, 63.52 per cent are male, while 36.48 per cent are female. In terms of age distribution, 7.43 per cent of respondents are under 25 years old, 47.98 per cent fall in the 25-35 age groups, 38.51 per cent are aged between 35 and 45 years, and 6.08 per cent are above 45 years old. Regarding marital status, 45.95 per cent of respondents are married, while 54.05 per cent are unmarried. Education-wise, 35.81 percent of respondents hold an HSC qualification, 46.63per cent are graduates and 17.56 per cent have postgraduate degrees.

Sources of information about Electric vehicle that affects buying decisions the most

Sources of information	No. of respondents	percentage
Internet and websites	18	12.16
Print Ads	12	8.11
Billboards	7	4.72
Friends and relatives	37	25
TV/Radio	13	8.78
Word of mouth	61	41.23
Total	148	100

(Source: Primary Data)

Table: 2 Sources of information about Electric vehicle



(Source: Primary Data)

Figure: 1

Tailoring the messaging to highlight specific benefits that align with the preferences of various groups can enhance the effectiveness of promoting electric vehicles. Information shared through word of mouth, online platforms, and websites can be particularly persuasive, with a focus on emphasizing environmental advantages and performance enhancements serving as compelling factors to encourage individuals to consider electric vehicles.

Components that stimulate buying decisions of Electronic Vehicle

The study tested the components that most influence buying decisions using the chi-square technique.

H0: There is no significant relationship between the age of the respondents and components that stimulate buying decisions

H1: There is a significant relationship between the age of the respondent and components that stimulate buying decisions

Age/ Components that stimulate buying decisions	Positive environmental concerns	Government initiatives	Improved infrastructure	Technological advancement	Cost savings	Total
Under 25	3	2	1	3	2	11
25 – 35	20	13	7	9	22	71
35 – 45	17	10	5	14	11	57
Above 45	2	2	1	2	2	9
Total	42	27	14	28	37	148

(Source: Primary Data)

Table: 3 Observed values

Age/ Components that stimulate buying decisions	Positive environmental concerns	Government initiatives	Improved infrastructure	Technological advancement	Cost savings
Under 25	3.12162	2.00	1.04	2.08	2.75
25 – 35	20.14	12.95	6.71	13.43	17.75
35 – 45	16.17	10.40	5.39	10.78	14.25
Above 45	2.55	1.64	0.85	1.70	2.25
chi-square value: 5.2035 * Significant at 5 percent level					

(Source: Primary Data)

Table: 4 Expected values

The study tested the components that most influence buying decisions using the chi-square technique. The calculated chi-square value was 5.2035, while the critical table value at a 5% significance level with 12 degrees of freedom was 21.026. Since the chi-square value is lower than the table value, the null hypothesis (H0) is accepted. This means that there is no significant direct relationship between the age of the respondents and the components that stimulate buying decisions.

Multiple Discriminant Analysis - Reason to shift to an electronic vehicle

Transitioning to an electric vehicle can help reduce carbon footprint by eliminating tailpipe emissions. To further diminish the environmental impact of charging EVs, can consider utilizing renewable energy sources from home electricity. The decision to switch to an electric vehicle is influenced by various factors, including environmental benefits, reducing the usage of fossil fuels, government initiatives, technological advancements, ease of driving, carbon emission reduction, cost-effectiveness, improved performance, social status, and reduced noise levels.

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.855	73.438	10	.000*

*** Significant at 5 per cent level**

(Source: Primary Data)

Table 5 Wilks' Lambda- Reason to shift to an electronic vehicle

The Wilks Lambda Matrix (Table 5) in Multiple Discriminant Analysis reveals a statistically significant Chi-square value (Chi-square value of 73.438 with p=.000<.05), indicating that the discriminant function accurately assesses respondents' perceptions regarding the motivation to switch to an electric vehicle.

Gender	Function
	1
Female	-.244
Male	.692

(Unstandardized canonical discriminant functions evaluated at group means)

(Source: Primary Data)

Table 6
Functions at Group Centroids

Reason to shift to an electronic vehicle	Function
	1
Environmental benefits	**-1.420**
Reduce the usage of fossil fuels	**.940**
Government initiatives	**.236**
Technological advancement	**-.123**
Easy to drive	**.121**
Reduce carbon emissions	**.384**
Social status	**-.259**
Improved performance	**-.321**

Economical and inexpensive	**.731**
Less noisy	**.134**

('Unstandardized canonical discriminant functions evaluated at group means')
(Source: Primary Data)

Table 7 Standardized Canonical Discriminant Function Coefficients

The analysis of the data from Tables 6 and 7 reveals distinct preferences among male and female respondents regarding the factors influencing their attitudes towards electric vehicles. Male respondents exhibit positive coefficients, indicating a stronger inclination towards reasons such as reducing the usage of fossil fuels and the economic advantages of electric vehicles. In contrast, female respondents show negative coefficients, suggesting a lesser influence from these factors.

Further examination of the standardized canonical discriminant function coefficient matrix in Table 7 highlights that the factors with the highest positive coefficients for male respondents are 'Reduce the usage of fossil fuels' (0.940) and 'Economical and inexpensive' (0.731). Conversely, the factors with the highest negative coefficients are 'Environmental benefits' (-1.420) and 'Improved performance' (-0.321), which have a greater impact on female respondents.

Therefore, when promoting electric vehicles to different gender groups, tailoring the messaging to emphasize the benefits that resonate with their preferences can be more effective. For males, focusing on the environmental and cost-saving aspects may be more persuasive, while highlighting the environmental benefits and performance improvements could be more compelling for females in encouraging them to consider electric vehicles.

CONCLUSION

Tailoring messaging and promotional efforts to highlight the specific benefits that resonate with each gender group can be an effective strategy in encouraging the adoption of electric vehicles. Emphasizing the environmental and cost-saving aspects may be more persuasive while focusing on environmental benefits and performance enhancements could be more compelling in promoting the adoption of electric vehicles.An in-depth examination of customer knowledge regarding electric vehicles revealed an intriguing contrast. There is a strong passion and curiosity for the technology and sustainability possibilities of electric cars, indicating a favourable attitude towards using these vehicles in the future. Youthful customers tend to have a more positive perception of electric vehicles due to their environmental consciousness and attraction to innovative technology, as indicated by the study. The study showed that consumers' views on electric vehicles are greatly influenced by environmental worries, with most participants acknowledging EVs as a more environmentally friendly option compared to conventional petrol cars. This environmental consciousness is strongly connected to the increasing anxiety about climate change and the customers' want to decrease their carbon impact. The survey revealed a dearth of consumer awareness of the specific environmental advantages of electric vehicles, indicating a good overall view but a deficiency in precise comprehension.

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